ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO
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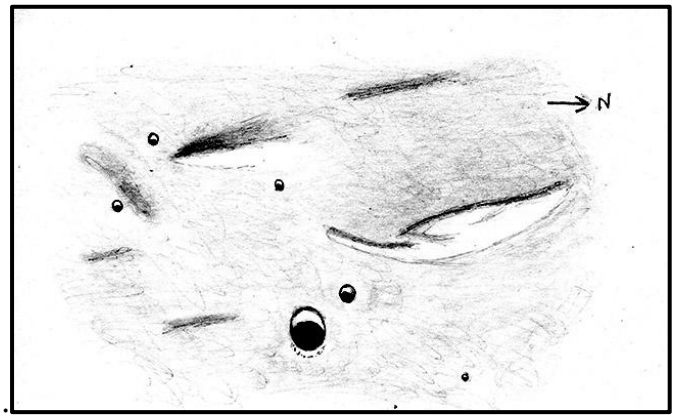
THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.
EDITED BY: Wayne Bailey wayne.bailey@alpo-astronomy.org
17 Autumn Lane, Sewell, NJ 08080
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – APRIL 2016

LeVerrier D



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
December 19/20, 2015 23:38-00:04 UT, 15 cm refl, 170x, seeing 8-9/10, Clear.

I drew this crater and nearby detail on the evening of Dec. 19/20, 2015. This area is in northeast Mare Imbrium, east of Le Verrier itself. Le Verrier D is the largest crater in this sketch. This is a crisp, midsized, symmetric crater. The smaller crater just to its northwest is Le Verrier B, and Le Verrier W is the smaller pit farther to the west. Le Verrier D and V are the small pits south of W, and are similar in size to it. (V is west of D.) The tiny pit north of Le Verrier D is Le Verrier X. This craterlet is smaller than W, D or V. All of these craters are sharply outlined, differing only in size. Several wrinkles are in this area. The most conspicuous one starts between Le Verrier B and W, runs north, then NNW before coming to a point. The east (sunward) side of this feature is quite sharply defined, more so than usual for a wrinkle. It's as though it rose fairly steeply from the mare. It showed a split shadow on its western (shadowed) side. Another wrinkle begins at a point near Le Verrier V and goes NNW, petering out near Le Verrier W. This wrinkle is fairly well defined at its pointed end near Le Verrier V, but widens and becomes vaguer while it passes Le Verrier W. A modest, linear strip of shadowing is northwest of Le Verrier W, and west of the main wrinkle. Another strip of linear shadowing is south of Le Verrier D, and a vague bit of shading is east of Le Verrier D. An ill-defined dusky area is also between Le Verrier U and V. The linear features in this area are generally parallel to each other, aligned approximately NNW-SSE.

Erratum: There was a typo in last month's article on Schiaparelli. The time that the dot of light appeared on the NW rim should read 5:25. It has been corrected in the on-line version.

LUNAR CALENDAR

APRIL-MAY 2016 (UT)

2016		UT	EVENT
Apr	05	17:27	Moon Descending Node
	06	08:30	Moon-Venus: 0.7° S
	07	11:24	New Moon
	07	17:36	Moon Perigee: 357200 km
	10	22:05	Moon-Aldebaran: 0.4° S
	12	12:12	Moon Extreme North Dec.: 18.3° N
	14	03:59	First Quarter
	17	00:46	Moon-Regulus: 2.7° N
	18	04:42	Moon-Jupiter: 2.4° N
	18	18:04	Moon Ascending Node
	21	16:05	Moon Apogee: 406400 km
	22	05:24	Full Moon
	25	19:28	Moon-Saturn: 3.7° S
	27	04:44	Moon Extreme South Dec.: 18.4° S
	30	03:29	Last Quarter
May	03	01:27	Moon Descending Node
	06	04:14	Moon Perigee: 357800 km
	06	19:30	New Moon
	08	08:21	Moon-Aldebaran: 0.5° S
	09	21:54	Moon Extreme North Dec.: 18.4° N
	13	17:02	First Quarter
	14	07:06	Moon-Regulus: 2.5° N
	15	09:30	Moon-Jupiter: 2.2° N
	15	20:39	Moon Ascending Node
	18	22:06	Moon Apogee: 405900 km
	21	21:15	Full Moon
	22	21:59	Moon-Saturn: 3.5° S
	24	11:16	Moon Extreme South Dec.: 18.5° S
	29	12:12	Last Quarter
	30	04:45	Moon Descending Node

AN INVITATION TO JOIN THE A.L.P.O.

The Lunar Observer is a publication of the Association of Lunar and Planetary Observers that is available for access and participation by non-members free of charge, but there is more to the A.L.P.O. than a monthly lunar newsletter. If you are a nonmember you are invited to join our organization for its many other advantages.

We have sections devoted to the observation of all types of bodies found in our solar system. Section coordinators collect and study members' observations, correspond with observers, encourage beginners, and contribute reports to our Journal at appropriate intervals.

Our quarterly journal, **The Journal of the Association of Lunar and Planetary Observers-The Strolling Astronomer**, contains the results of the many observing programs which we sponsor including the drawings and images produced by individual amateurs. Additional information about the A.L.P.O. and its Journal is on-line at: **http://www.alpo-astronomy.org.** I invite you to spend a few minutes browsing the Section Pages to learn more about the fine work being done by your fellow amateur astronomers.

To learn more about membership in the A.L.P.O. go to: **http://www.alpo-astronomy.org/main/member.html** which now also provides links so that you can enroll and pay your membership dues online.

When submitting observations to the A.L.P.O. Lunar Section

In addition to information specifically related to the observing program being addressed, the following data should be included:

Name and location of observer
Name of feature
Date and time (UT) of observation
Size and type of telescope used
Magnification (for sketches)
Filter (if used)
Medium employed (for photos and electronic images)
Orientation of image: (North/South - East/West)
Seeing: 0 to 10 (0-Worst 10-Best)
Transparency: 1 to 6

Full resolution images are preferred-it is not necessary to compress, or reduce the size of images. *Additional commentary accompanying images is always welcome.* **Items in bold are required. Submissions lacking this basic information will be discarded.**

Digitally submitted images should be sent to both
Wayne Bailey – wayne.bailey@alpo-astronomy.org
and Jerry Hubbell –jerry.hubbell@alpo-astronomy.org

CALL FOR OBSERVATIONS:

FOCUS ON: Kepler

Focus on is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **May 2016** edition will be **Kepler.** Observations at all phases and of all kinds (electronic or film based images, drawings, etc.) are welcomed and invited. Keep in mind that observations do not have to be recent ones, so search your files and/or add this to your observing list and send your favorites to (both):

Jerry Hubbell –jerry.hubbell@alpo-astronomy.org

Wayne Bailey - wayne.bailey@alpo-astronomy.org

Deadline for inclusion in the Kepler article is April 20, 2016

FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for potential contributors the following targets have been selected:

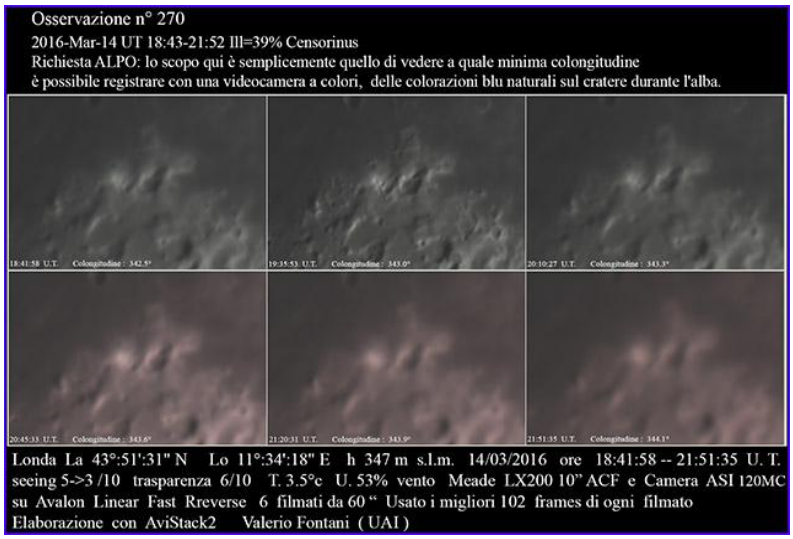
Subject	TLO Issue	Deadline
Capuanus-Palus Epidemiarum	July 2016	June 20, 2016
Montes Apennines-Palus Putredinis	September 2016	August 20, 2016

REQUEST FOR OBSERVATIONS

Franco Taccogna, Union of Amateur Astronomers Italian (UAI), has requested observations of Gassendi and Censorinus. Both requests relate to time dependent changes. In the case of Censorinus, the object is to determine when blue color is visible. His requests, with some examples of observations follow. Observations can be sent to Franco at tfp2255@gmail.com. Observations are also welcome to be sent to the ALPO Topographical Studies and Lunar Geological Change programs.

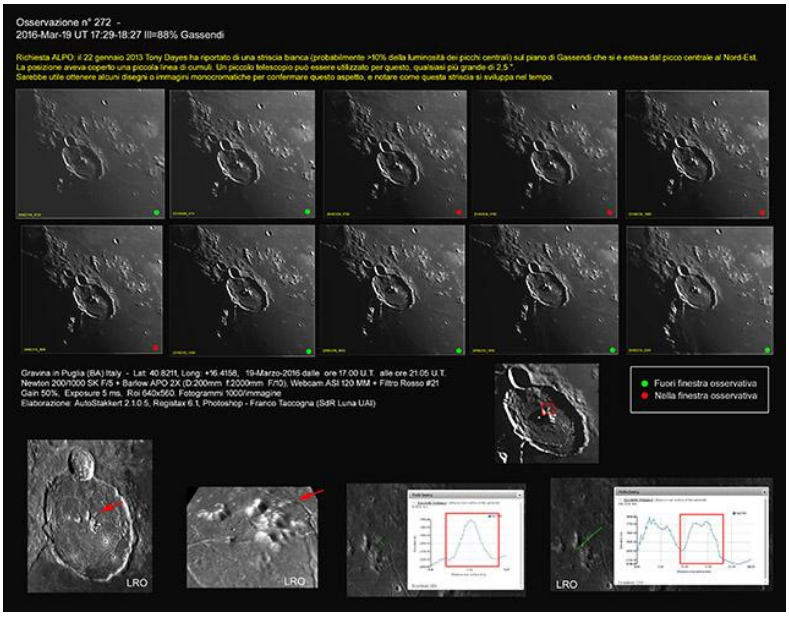
CENSORINUS

The aim here is simply to see at what earliest colongitude can you record with a colour camera, natural blue color on the crater during sunrise. The effect can be quite impressive.
Try to get the exposure right else the crater will be saturated white and you will not capture any colour.



GASSENDI

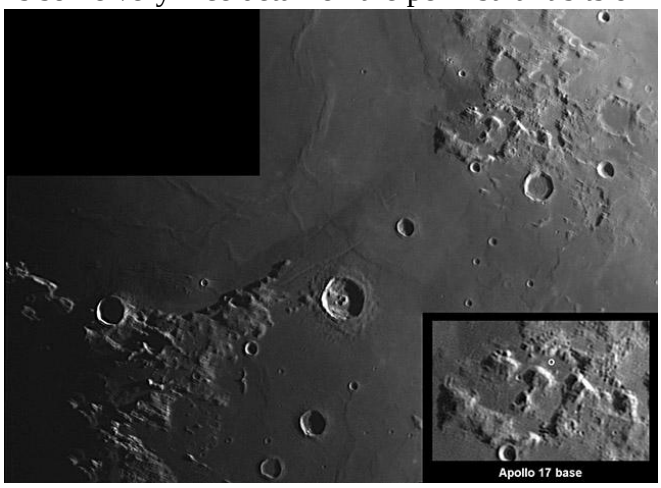
On 2013 Jan 22 Tony Deyyes noticed a white streak (possibly >10% brightness of the central peaks) on the floor of Gassendi extending from the central peak to the north east. The location covered a small line of mounds. A small scope can be used for this, anything larger than 2.5". It would be useful to obtain some sketches or monochrome images to confirm this appearance, and note how this streak develops over time



OUR LAST LOOK

Richard Hill

This is literally the boundary between Mare Tranquillitatis (lower right) and Mare Serenitatis (upper left). The large crater near the center of the two image montage is the 44km diameter Plinius, showing nice interior detail like the slumped walls and a central peak that looks like a possible caldera. Even in the LROC QuickMap it has that appearance. To the left, still deep in shadow, is the 27km Menelaus. There is some very nice detail on the peninsula it sits on that ends in Promontorium Archerusia very near Plinius. Between them you can see Rimae Plinius.



APOLLO 17 *– Richard Hill – Tucson, Arizona, USA March 15, 2016 01:48 UT. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.*

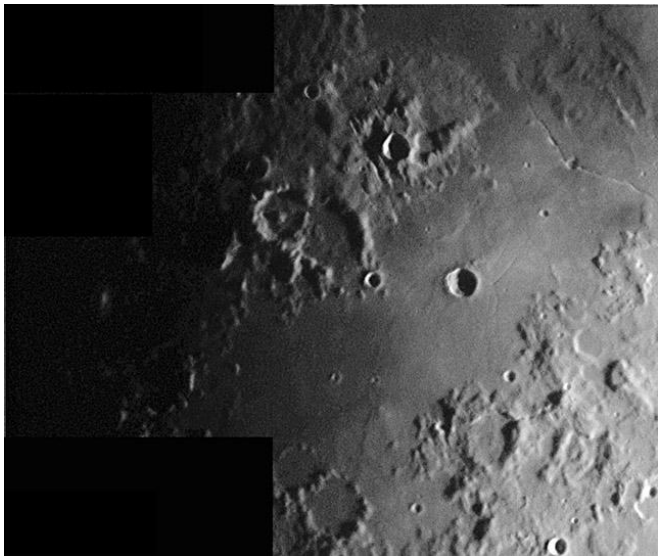
To the upper right from Plinius is the 27km crater Dawes. These two point the way to a curious row of 4 mountain peaks. This marks the spot where Apollo 17, man's last visit to the moon, had its base. The second peak in from the left was known as "South Massif" and the Apollo 17 base was just north of it as shown in the inset image, marked with an "o". Just below my mark is a little hill that the astronauts called "Bear Mountain". North of the landing site on the larger image is a flat bottomed, oval, mostly ruined crater. This is Littrow, and is listed as 32km diameter but clearly it is not round. The nicely round crater below is the 31km Vitruvius.

These two merged images were each made from 600 frames out of 3000 frame AVIs stacked with Registax6. The images were merged with AutoStitch and further processing done with GIMP and IrfanView.

SINUS MEDII - BAYWATCH

Richard Hill

Right in the middle of the visible disk of the moon is a small "sea" that many lunar observing tyros learn about early on. This is, aptly named, Sinus Medii or the Middle embayment. There are many interesting things within its borders. It was shown in the earliest sketches of the lunar surface, contemporary with Galileo though he did not clearly note it. In the center of this lunar estuary is the ever popular Triesnecker (27km dia.) with it's beautiful system of rimae surrounding it. If the sun had been a bit lower here they would have shown up somewhat better. Up and to the right of Triesnecker is the familiar crack in the moon, Rima Hyginus with the central 10km caldera-like crater of the same name. This rima is different than the Triesnecker rimae, being composed of a series of what look like outgassing vents of volcanic origin.



SINUS MEDII *– Richard Hill – Tucson, Arizona, USA February 16, 2016 02:07 UT. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.*

On the other end of Medii about the same distance from Triesnecker as Hyginus is, are two small craters. The larger one is the 7km Bruce and the smaller the 5km Blagg. Just to the lower left of Bruce, about 1½ times the distance between Bruce and Blagg, is the site where two of the Surveyor programs landers had their final resting places. Surveyor 4 lost communication with Earth about 2½ minutes before touchdown on 17 July, 1967 and its exact location is not known. On 10 Nov., the same year, Surveyor 6 landed very near both Survey 4 and the zero longitude/latitude point at the center of the disk. Surveyor 6 was the first man-made spacecraft to lift off of a body and land back again. The experiment moved the spacecraft only about 10 feet but was successful. This was also the mission that tested vidicon TV transmission experimenting with filters and shutters that would later be used in the Apollo program.

Before leaving this area take a look at the two merged craters directly to the left of Triesnecker. These are Murchison (60km) and further, Pallas (51km). Directly below is vertically elongated Rhaeticus. It is listed as having the same diameter as Pallas but with the 20-30% elongation it seems difficult to believe. Lastly, to the left of Rhaeticus, is the basalt flooded crater Oppolzer (44km).

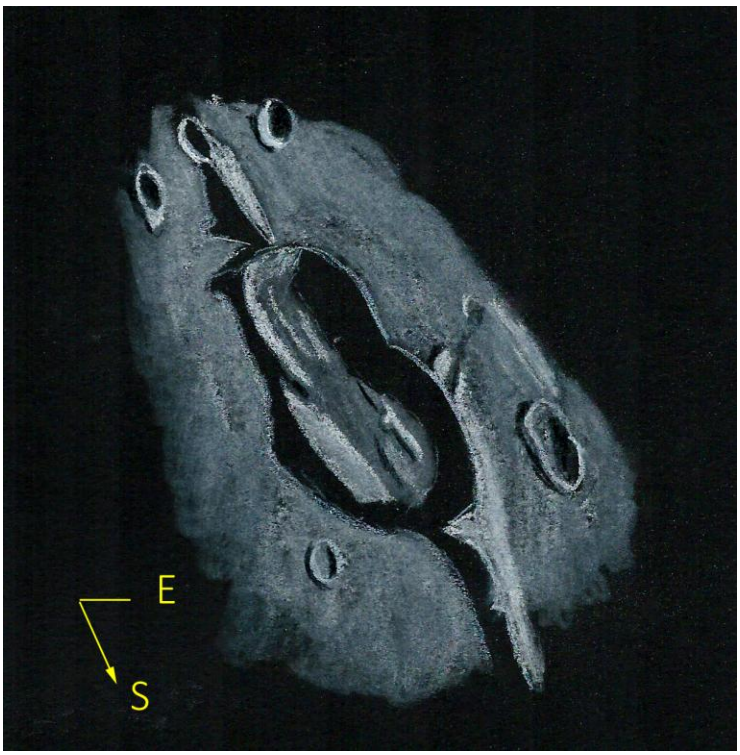
HAINZEL

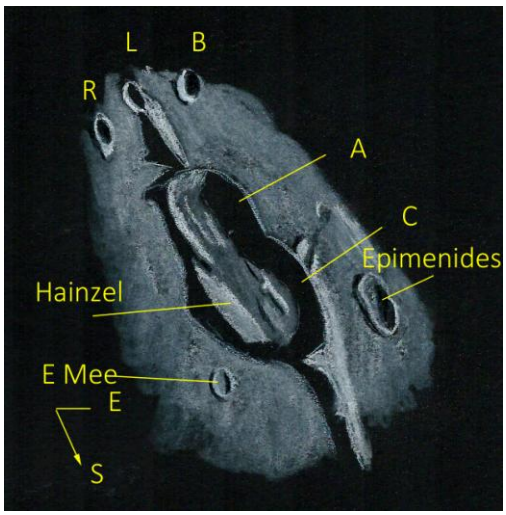
David Teske

I made this sketch on the early evening of 18 February 2016 (19 February 2016 UT) using a 60 mm f/16.7 fl 1000 mm Moon Raker refractor telescope. A 6 mm Burgess/TMB eyepiece was used with a magnification of 167. The telescope was mounted on a Losmandy GM8 mount. The observation was made between 0150 and 0240 UT. Seeing was 9/10 under clear skies. The moon was waxing gibbous phase. Medium was white and black pastel on black Strathmore Artagain drawing paper. The observation was made by David Teske in Starkville, Mississippi. A duplicate sketch is labeled.

Hainzel appears to be a triple crater. Hainzel itself is on the southwest of the formation. It has a diameter of 70.6 km. The floor has a distinct mountain that separates Hainzel from Hainzel C. Hainzel C seems to be a bit more defined, with a diameter of 38 km. North of this is Hainzel A. This crater seems the best defined of the three craters with a diameter of 56 km. Its western wall in the sunlight shows some terracing. The western wall seemed to extend into the area of Hainzel. There were two linear light streaks on the floor of Hainzel A that were aligned north-south. The eastern quarter of the floors of Hainzel and Hainzel A were in shadow.

East of Hainzel C was the elongated crater Epimenides. With a diameter of 27 km, this crater was elongated in the north-south direction. Its walls seem low. Extending off the walls to the east of Hainzel C were two small hills. To the north of Hainzel A was a hill that that had a peak near its southern end as indicated by its shadow. Immediately north of this hill was the sub-crater L with a diameter of 15 km. Directly southwest of sub-crater L was sub-crater R with a diameter of 17.5 km. To the east was sub-crater B with a diameter of 15 km. All three of these craters looked similar. West of Hainzel was the sub-crater Mee E with a diameter of 16 km. Mee E appeared to have low walls.





Petavius Crater Near Waxing Terminator

By Stephen Tzikas

Petavius Crater was my first focused effort in learning to sketch. This short article presents the evolution of my sketching skills, from a simple line drawing to a more comprehensive illustration. Petavius is a large crater located to the southeast of the Mare Fecunditatis. Attached to the northwest rim is the smaller crater Wrottesley. To the southeast are Palitzsch, Vallis Palitzsch, and Hase craters. Petavius appears oblong when viewed from the Earth due to foreshortening. A certain peculiarity I have noticed when sketching Petavius is that it can appear roundish, which is evident in my sketches. I am not sure why I sometimes get that perception, but in my opinion it may have to due with the eye's interaction with a very complex wall and surrounding structure that distorts the eye's perspective. Even after nearing the completion of the ALPO training program for sketching, this perception of roundness persisted, even though I knew it was an oval crater in appearance. This type of perceptual illusion developed an interest in reviewing early 17th and18th century sketches of the Moon where perception may have been more dominant over sketching skills. I have also noticed that perceptual illusion plays a role in the sketching of complex and unfamiliar lunar terrain. Good examples of this is in the sketching of the lunar polar regions were dominant features are lacking for anchors, or unusually shaped craters like Delauney, that offer challenges that don't fit the mind's preconceived pattern of crater recognition. When I tried to sketch the south polar region (e.g., Scott crater) and Delauney crater, the results did not match reality. Petavius is not an obvious perceptually challenging crater as it is large and has great contrasts, but it belies an interesting subtleness that may be realized in the exercise of sketching it.

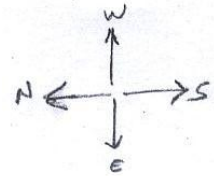
The outer wall of Petavius is wide in proportion to the diameter, and displays a double rim along the south and west sides. The height of the rim varies and the crater floor displays a rille system (also called walls) named the Rimae Petavius. The large central mountains are a prominent formation with multiple peaks, climbing 1.7 kilometers above the floor. A deep fracture runs from the peaks toward the southwest rim of the crater.

Petavius crater is one of the finest spots to observe on the Moon with its grand double rampart on east side nearly 11,000 feet high, its terraces, and its interior with central hill and cleft. It offers a magnificent landscape in the lunar morning or evening. However, Petavius crater nearly vanishes beneath a rising Sun losing all shadows. Indeed, a rather wide area simplistic drawing I did (March 10, 2014, Col 24.65) of the Moon in the locale of Petavius under such conditions appeared so devoid of any discernable details, that it was nearly unrecognizable when I took it out for review on a later date. I did not include in here for that reason.

Petavius has a number of satellite craters. By convention these features are identified on lunar maps by placing the letter on the side of the crater midpoint that is closest to Petavius. Petavius' satellite craters range in size from 5 to 17 km. These satellites craters include those designated by the letters A, B, C, D, and E. The USGS Digital Atlas of the Moon contains charts that are part of the Lunar Astronautical Chart (LAC) series. Chart (LAC 98) identifies the satellite crater locations around Petavius. The LAC charts are available online without cost. Petavius B (not in my

sketches) to the north-northwest of Petavius has a small ray system that lies across the surface of Mare Fecunditatis. Due to these rays, Petavius B is mapped as part of the Copernican System.

Table 1: Petavius Crater Sketches



Basic direction: Top (Western sky), Bottom (Eastern sky), Right (South), Left (North)
(IAU coordinates-East up, North left).

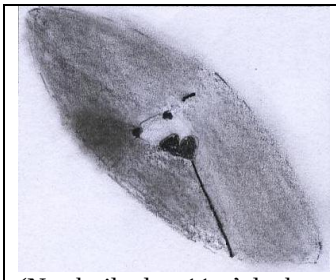
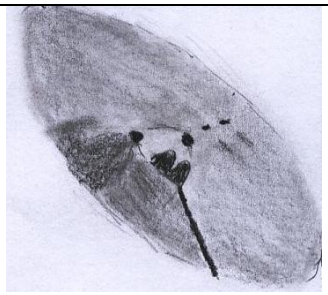
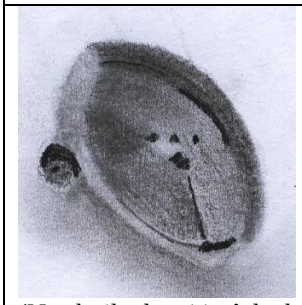
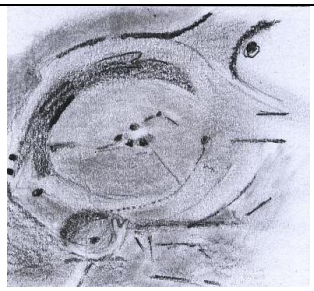
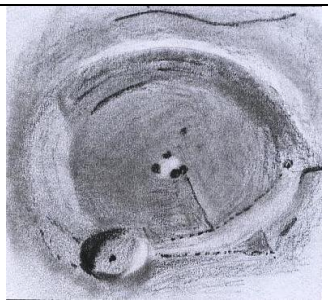
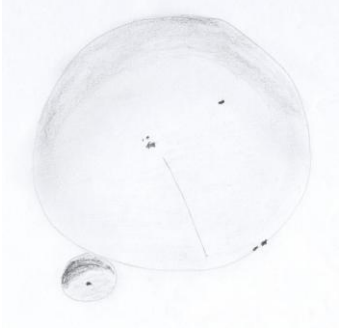
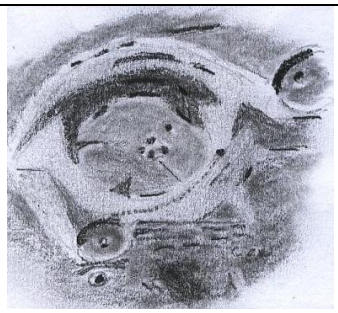
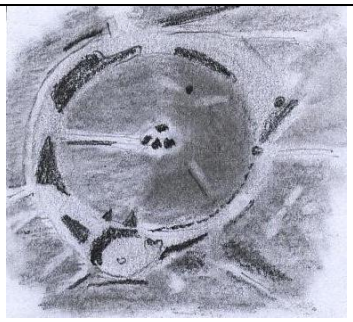
 (North tilted to 11 o'clock position) UD June 1, 2014 UT 1:05 – 1:18 CoL: 305.71	 March 4, 2014 ~CoL 311.57 (reconstructed)	 (North tilted to 11 o'clock position) UD June 2, 2014 UT 0:28 – 0:38 CoL: 317.62
 (North tilted to 11 o'clock position) UD July 31, 2014 UT 1:17 CoL: 319.05	 UD December 25, 2014 UT 22:10 – 23:05 CoL: 321.44	 UD October 27, 2014 UT 22:00 to 22:38 CoL: 323.49
 March 5, 2014 ~CoL: 323.76 (reconstructed)	 UD December 26, 2014 UT 22:35 – 23:50 CoL: 333.92	 UD December 27, 2014 UT 22:20 – 23:44 CoL: 345.99

Table 2: Petavius Crater Observational Notes

Time (UT)	CoL.	Observational Notes
June 1, 2014 1:05 – 1:18	305.71	This is one of my attempts at Petavius crater at the very beginning of my ALPO training. It is a small step above crude. I remember trying to strive so much to extract some features that I did not have time for the wall. The focus is in the interior of the crater. The details of layering in the wall were not attempted. The narrower focus allowed me to see more detail in the crater interior.
March 4, 2014	~Col 311.57 reconstructed	This is my first attempt at sketching Petavius crater, without any ALPO training. I decided to include this crude sketch because of its basic features and shadow orientation in the colongitude period of interest.
June 2, 2014 0:28 – 0:38	317.62	This is one of my attempts at Petavius crater at the very beginning of my ALPO training. It is a small step above crude. I remember trying to strive so much to extract some features that I did not have time for the wall. The focus is in the interior of the crater. The details of layering in the wall were not attempted sketched during bright twilight.
July 31, 2014 1:17	319.05	This sketch was drawn near Moon-set towards dark twilight. Petavius crater wall had rough texture layering unable to resolve further.
Dec 25, 2014 22:10 – 23:05	321.44	Walls (rima) II and III were seen for the first time, including the bright craterlets near wall III.
Oct. 27, 2014, 22:00 to 22:38	323.49	Petavius crater appeared more roundish rather than oblate. Elevation effects in the south-east external wall of Petavius were noticeable but difficult to sketch. Also noticeable for the first time was the dotted nature of the two rims or layering lines on Petavius' south-east wall. Some subtle differences in tomes (half tomes) were noticed as well.
March 5, 2014	~Col 323.76 reconstructed	This is my second attempt at sketching Petavius crater, without any ALPO training. I decided to include this crude sketch because of its basic features and shadow orientation in the colongitude period of interest.
Dec 26, 2014 22:35 – 23:50	333.92	Petavius C is a small dark crater landmark in all my sketches. Tonight it has a very thin bright ring "around it," but unable to capture it in this sketch as it is so fine.
Dec 27, 2014 22:20 – 23:44	345.99	Wrottesley crater is the smaller crater to the east of Petavius – under it in the sketch above. A lot of new detail is seen external to Petavius on both sides of Wrottesley. For the first time, wall "I" is bright rather than dark. Wall II however is the most dominating in this phase and is quite bright.

LUNAR TOPOGRAPHICAL STUDIES

Coordinator – Wayne Bailey - wayne.bailey@alpo-astronomy.org

Assistant Coordinator – William Dembowski - dembowski@zone-vx.com

Assistant Coordinator – Jerry Hubbell – jerry.hubbell@alpo-astronomy.org

Website: http://moon.scopesandscapes.com/

OBSERVATIONS RECEIVED

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 10 & 11 day moon, Aristarchus(2), Clavius, Copernicus(2), Gassendi, Gruithuisen, Lansberg, Mare Humorum(5), Schiller-Zucchius, Sinus Iridum & Tycho.

CRANDALL, ED – LEWISVILLE, NORTH CAROLIA, USA. Digital image of Alphonsus.

HOWARD ESKILDSEN - OCALA, FLORIDA, USA. Digital image Mare Humorum.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Apollo 17 area, Heraclitus, Montes Alpes, Murchison & Sinus Medii.

FRANCO TACCOGNA - GRAVINA IN PUGLIA (BA), ITALY. Digital images of Censorinus(8) & Geassendi(23).

DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Drawings of Kepler & Hainzel.

STEVE TZIKAS - RESTON, VIRGINIA, USA. Drawings of Peatavius(9).

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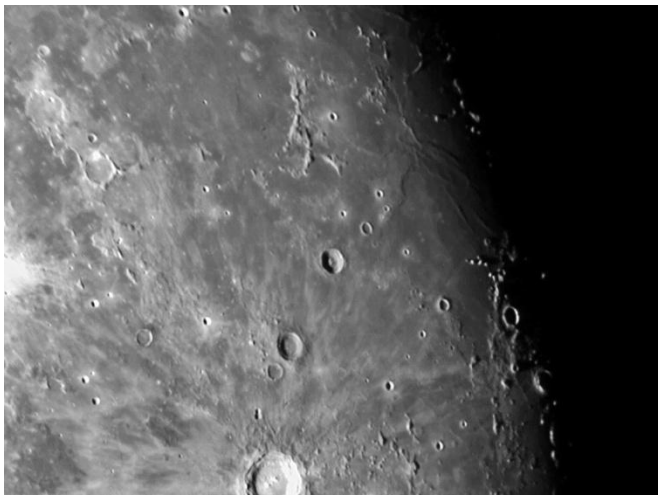
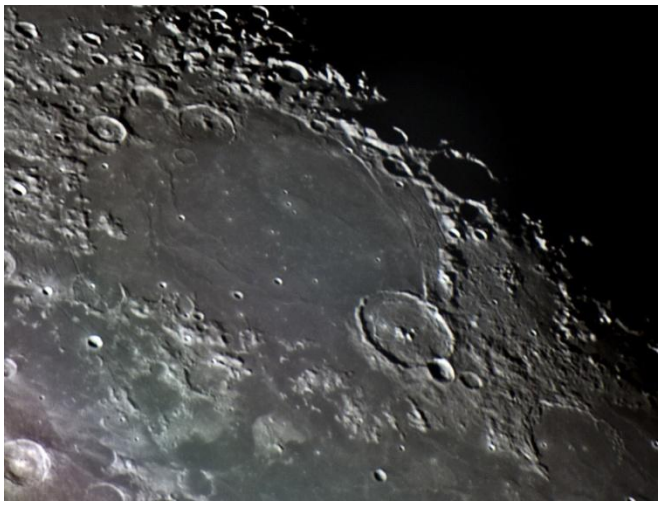
RECENT TOPOGRAPHICAL OBSERVATIONS

GRUITHUISEN - Maurice Collins, Palmerston North, New Zealand. March 20, 2016 08:15 UT. FLT-110, f/21, ASI120MC. (South up)

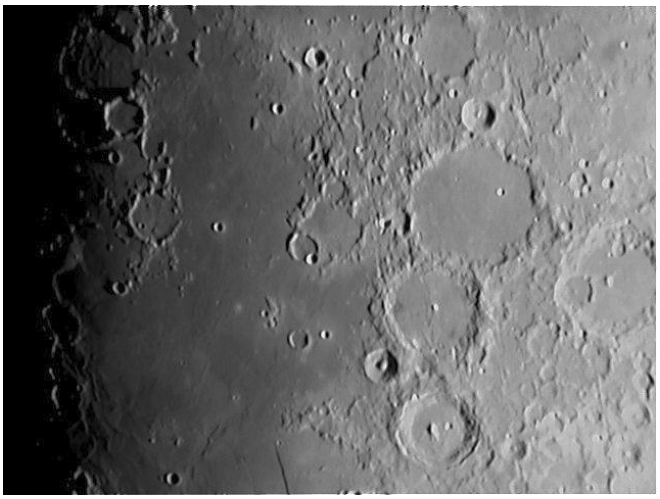


LANSBERG - Maurice Collins, Palmerston North, New Zealand. March 19, 2016 07:59 UT. FLT-110, f/14, (South up)

MARE HUMORUM - Maurice Collins, Palmerston North, New Zealand. March 19, 2016 07:58 UT. FLT-110, f/14, (South up)

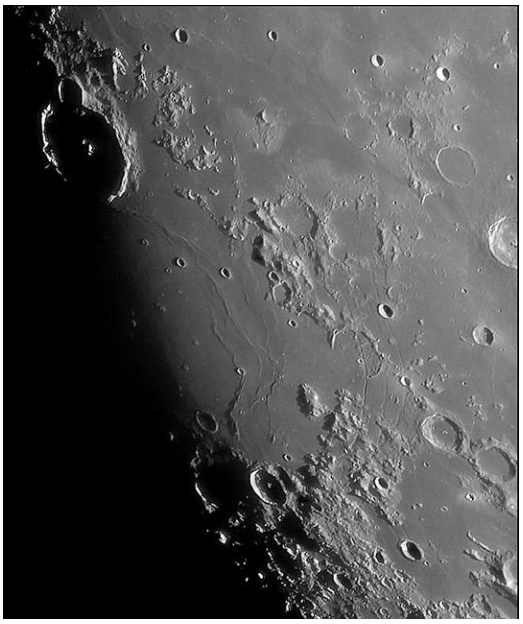


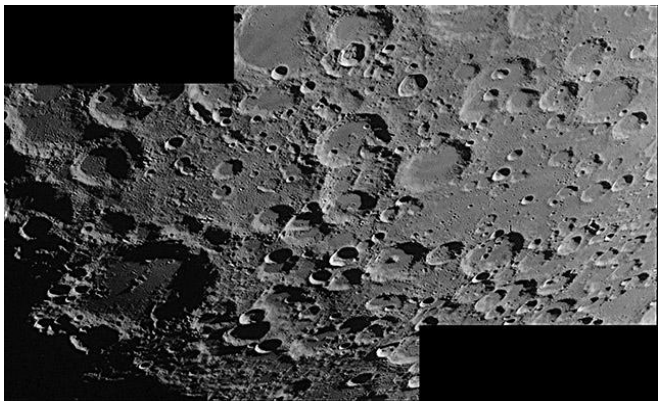
MARE HUMORUM - Maurice Collins, Palmerston North, New Zealand. March 20, 2016 08:12 UT. FLT-110, f/21, (South up)



ALPHONSUS – Ed Crandall, Lewisville North Carolina, USA. December 19, 2015 23:22 UT. 110 mm, f/6.5 APO, 2X barlow. Seeing A-III. Colongitude 18.5º. ToUcam.

MARE HUMORUM- Howard Eskildsen, Ocala, Florida, USA. February 18, 2016 23:46 UT. Seeing 7/10, Transparency 5/6. 6" f/8 Refractor, 2x barlow, DMK 41AU02.AS.





HERACLITUS– Richard Hill – Tucson, Arizona, USA March 17, 2016 02:30 UT. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.

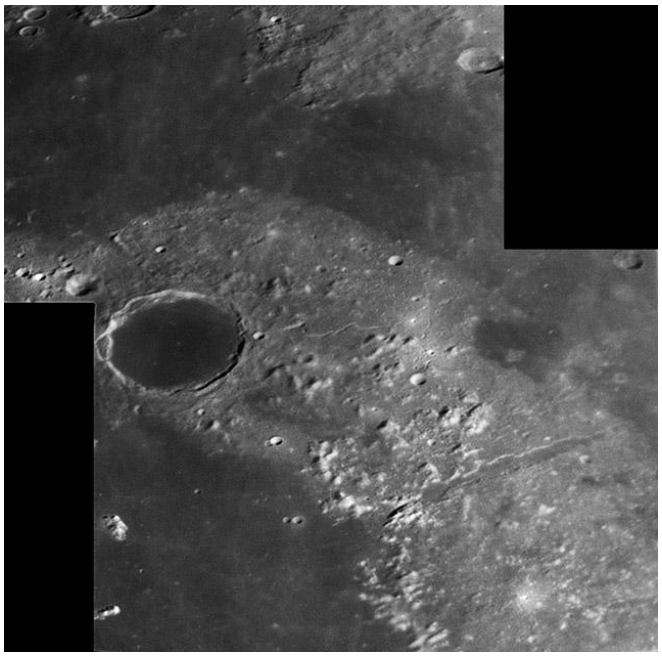
There are just some lunar features that never fail to fascinate. Heraclitus is one of those. It can be seen here as an odd blong, roughly vertical feature with a ridge down the center. It xtends down from the 75km diameter crater Licetus and is bordered by another 77km flat bottomed crater, Cuvier, on the right. This grouping forms a sort of Mickey Mouse head. below and to the left is a curious formation of two or three craters with a straight wall between them. On the left side of this straight wall is the 40km Lilius F. Note the curved line of 2-2.5km secondary craters on the floor of this crater. Take a look and you'll see this whole region is peppered with 1-3km secondary craters.

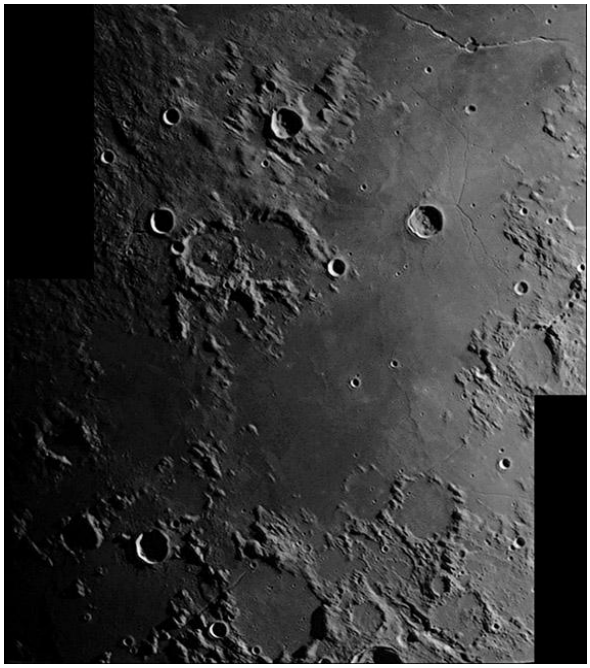
To the lower left of Heraclitus is a crater with a nice central peak. This is the 61km Lilius itself. It's a little odd in that it has a central peak while larger craters in the region do not.

The large crater on the left is Maginus, the largest crater visible in this image at 168km. At the very top is the smooth bottomed 129km diameter Stofler, with its floor streaked with ejecta from the Tycho impact, just outside the left edge of this image.

MONTES ALPES – Richard Hill – Tucson, Arizona, USA January 21, 2016 04:36 UT. Seeing 7/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.

This was a particularly favorable libration for this region of the moon and observing it paid dividends. We see the ever popular Plato and Vallis Alpes region. Note that the 104km diameter Plato, normally a dark oval, is nearly circular due to the libration. The seeing was pretty good and I managed to get 4 of the 2-2.5km craterlets on the floor of the great walled plain. Much of the rima on the floor of Vallis Alpes can also be seen. I like the sparkling 2400m peaks of Mons Pico just below Plato. Rimae Plato can be seen to the right of the great crater like a stream draining a pond. Notice that the mountains for just about one crater diameter around Plato are softened by a blanket of ejecta from the formation of the crater.





MURCHISON – Richard Hill – Tucson, Arizona, USA March 17, 2016 02:08 UT. Seeing 8-9/10. TEC 8” f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.

This is another of those "elephant in the room" shots. Everyone gets distracted by Triesnecker and Hyginus and their associated rimae, in the upper right portion of this image and they tend not to notice the side by side craters just above the middle of this image. The one on the right is the 60 km diameter Murchison. It's age is listed as 3.92-4.55 billion years old (b.y.). Overlapping it on the left is the well formed 51km crater Pallas with a central peak. The age of this crater is 3.92-3.85 b.y. The relative difference between the two is hinted at by the position of the younger on top of the older. Pallas is physically somewhat higher than Murchison as in the northern portion of the contact between them, a channel can be seen, a break in Pallas' wall. On LROC QuickMap this shows as a flow channel from Pallas into Murchison, called "lava in communication" by some selenographers.

Directly above Murchison is the 24km crater Ukert. It sits in a field of parallel impact scars reminiscent of glaciation grooves or striations, but I assure you this is not the case here! At the very bottom of the image you can see more such impact scarring through the crater walls of the 77km flat bottomed crater Flammarion with the nice Rima Oppolzer going through the north end of it and on into the 44km crater Oppolzer to the left. All the craters in this area are raked with impact scarring, except for the very youngest ones like the one on the left wall of Flammarion or the 27km Mosting above and to the left of that. These are the kinds of things that allowed pre-spacecraft selenographers to relatively age date lunar features.

GASSENDI – Maurizio & Francesca Cecchini · Montalcino, ITALY (via Franco Taccogna). March 19, 2016 20:22 UT. Seeing 7/10. C-14 XLT, 2.49x barlow, ASI 174mm, Astronomik red filter.

CENSORINUS – Valerio Fontani, (UAI) ITALY (via Franco Taccogna). March 14, 2016 19:36 UT. Seeing 5/10, transparency 6/10.. 10” LX200 ACF, ASI 120MC.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

Coordinator – Dr. Anthony Cook – atc@aber.ac.uk
Assistant Coordinator – David O. Darling - DOD121252@aol.com

Observations/Studies for February were received from: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Agrippa, Aristarchus, Censorinus, Mare Crisium, Petavius, Plato, Proclus, and the SE and W Limbs. Alberto Anunziato (Argentina – AEA) made sketches of: Bianchini G, Eratosthenes, Gassendi, Maurolycus, and imaged Mare Crisium. Kevin Berwick (ALPO – Ireland) observed and sketched: Alphonsus, Aristarchus, Censorinus, Picard and Plato. Bruno Cantarella and Luigi Zantatta (UAI – Italy) videoed Earthshine. Marc Charron (Reading Astronomical Society, UK) imaged the whole Moon. Maurice Collins (New Zealand – ALPO) imaged: Alexander, Alphonsus, Mare Imbrium, Sinus Iridum, Tycho and the whole lunar disk. Marie Cook (Mundesley, UK – BAA) observed: Albategnius, Alphonsus, Archimedes, Aristarchus, Atlas, Bullialdus, Grimaldi, and Plato. Tony Cook (Newtown, UK – BAA) captured webcam images of several features. Rik Hill (Tucson, AZ, USA – ALPO) imaged: Aristarchus, Clavius, Sinus Medii, Theophilus, Tycho and Walther. Nigel Longshaw (Oldham, UK - BAA) observed: Albategnius, Mons Piton, Picard and Ptolemaeus. Aldo Tonon (Italy – UAI) imaged: Herodotus. Gary Varney (FL – ALPO) imaged several features.

News: It appears that since upgrading from Windows 7 to 10 Operating System, on my computers, the repeat illumination prediction software has been producing significantly less candidate observing targets than it used to do. This fault has now been traced to the fact that the directory listings that I use to populate the LTP database are now in Unicode (2 bytes per character) rather than ASCII (1 byte per character) and this has confused the software so that it is skipping observations. Unicode is used to allow for additional characters such as “ö”, “á”, “ê” etc. Whilst this is very important in international languages, it can cause havoc with old software that just allows for ASCII characters (a-z, A-Z etc). I am working on this problem and will hopefully have a solution by next month and then we will get back to a more reasonable number of observing targets on our repeat illumination web site.

LTP Reports: No LTP reports were received in February, though Bruno Cantarella and Luigi Zantatta (UAI) captured a flash in their video of Earthshine on 2016 Feb 11 UT 18:17. However it looks like a cosmic ray detection as it is a little too sharp for an impact flash (See Fig 2 (Right)).

Wayne Bailly forwarded onto me an interesting email from John Craig, John had been watching the weather forecast on his local TV station KWGN Denver 2, when they showed a nice live shot of the crescent Moon and Earthshine on 2016 Mar 11 UT 02:49. John saw a point of light on the Moon’s night side and had the foresight to get out his camera phone and take a snap shot off the screen (See Fig 1). The Weather Girl on the TV station apparently did not mention the interesting point of light in Earthshine. Upon seeing the image that John took off the TV screen, my first impression was that there were other star-like points, and that this looked possibly like the effects of a cosmic ray air shower on a camera. But of course that would only be visible in one frame of the video feed. Assuming the bright points were not from a cosmic ray air shower, both I and Wayne Bailly, checked for stars near the Moon using some software/on-line tools, but could not find any such configuration of stars next to the Moon at the given date and UT. So was the bright point seen against the Moon actually on the Moon or not? One possibility was that the point(s) were hot pixels on the camera chip. Consider the time it took to show the Moon on the TV (10-15 Sec), in that time the Moon would have drifted through approximately $1/12^{th}$ - $1/8^{th}$ of its own diameter (assuming the TV camera was not tracking), so the bright point on the Moon might have appeared to have moved against the lunar surface very slightly. John comments that he did not think that the point moved relative to the Moon, it was yellow-white in color, and it may have even been twinkling slightly - however he may not have been looking all the time as he would have had to have looked

away to get his smart phone in order to take a picture. We do not think that the bright point on the night side of the Moon was Aristarchus either, because although that feature can be quite bright in Earthshine, it is not so close to the limb? It was probably not an impact flash as these are usually red in color, normally much shorter in

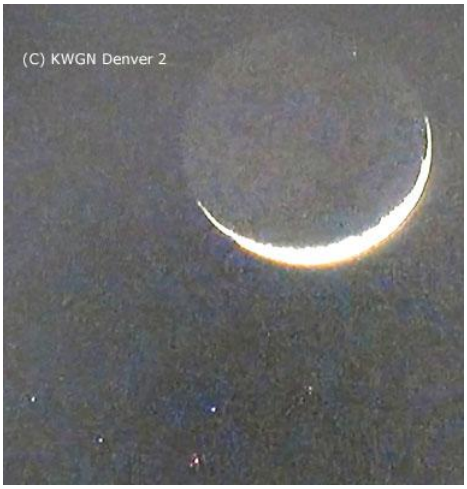


Figure 1. A telephone camera shot off of a TV screen from a broadcast of a KWGN Denver 2 TV channel showing the crescent Moon and Earthshine. North is towards the top right and a copyright label has been added to the image.

duration, and fainter, and anyway fade over time. The star like features in the bottom left corner of the image are clearly not stars – which leads myself and Wayne to re-affirm our belief that these were hot pixels on the camera – these become more noticeable at low light levels, which the KWGN camera would have been operating at in the evening concerned. (Update Mar 29th 2016 – John Craig has just emailed to say that he had managed to get hold of a copy of the KWGN Denver 2 video, and found that the bright point on the Moon was indeed static with respect to the camera image, and not with respect to the drifting Moon – therefore he too is now pretty sure that this was a hot pixel).

Routine Reports: Below is a selection of reports received for February that can help us to re-assess unusual past lunar observations.

Aristarchus: On 2016 Feb 11 UT 18:17 Bruno Cantarella and Luigi Zantatta (UAI) were videoing the Moon for impact flashes (this has already been discussed in the news section) under the same topocentric libration and Earthshine illumination angles (to within ±1˚) to a LTP report by David Darling from 1980:

On 1980 Jan 21 at UT00:30-01:30 D. Darling (Sun Praire, WI, USA, 12.5" reflector, x62, seeing 3/10, transparency poor and the Moon's altitude was low) found Aristarchus "glowing" in Earthshine, it changed brightness and shape - streamers were visible - this was similar to his 1979 Jun 30'th LTP report. Cameron 2006 catalog ID=82 and weight=0. ALPO/BAA weight=1.

Slightly earlier in the evening at 17:57 UT Marco Charon (Reading Astronomical Society) took an image of the Moon (Fig 2 (Left)), which apart from encompassing the above 1980 observation, was also a repeat illumination (to within ±0.5˚) to the following LTP report from 1822:

On 1822 Jun 22 at UT 21:20 Ruppell (Germany?) observed a "lunar volcano" in Aristarchus. The Cameron 1978 catalog ID=96 and the weight=1. The ALPO/BAA weight=1.

Note that although the UAI image viewing geometry and illumination direction were identical to what David Darling would have seen back in 1980, we cannot replicate the Earth's albedo (reflectivity), or surface color, at this time, or indeed differences in transparency between the old and modern observing sites. Bruno and Luigi's captured video frame though does show Aristarchus to be nice and bright compared to Kepler and

Copernicus, and so this would fit with David's description of the crater glowing in Earthshine. An apparent star can be seen off the NW limb – I have tried to identify the star, but it comes out at magnitude 11, which seems a bit too faint for what is showing up in the image, so maybe it's a hot pixel or a cosmic ray? However Aristarchus was nowhere near as bright as any of the sunlit peaks on any part of the terminator, based upon Marco's image (Fig 2 (Left)). I cannot really comment upon David Darling's description – the SW ray of Aristarchus might have appeared as a streamer? – However if the Moon was low, the transparency was poor, it is possible that general atmospheric conditions/refraction near the horizon, might have contributed to variations in brightness and shape? Based upon the images in Fig 2, and re-reading the 1980 report (This was given originally a weight of 0 in the Cameron catalog), I think I will lower the ALPO/BAA weight of 1 back down to 0 again. For the 1822 observation, we do not have enough information about what was seen originally, and so will keep the weight at 1.

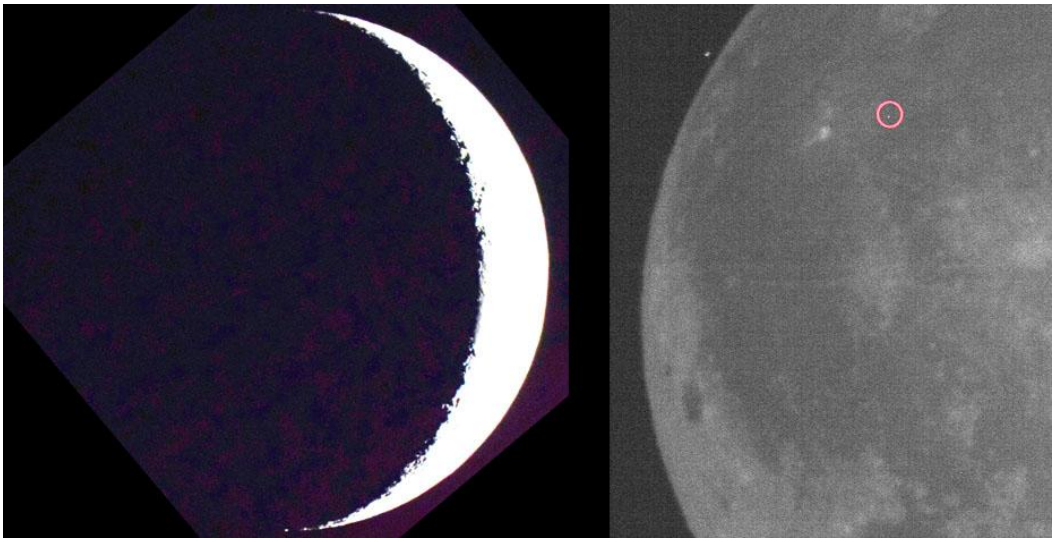


Figure 2. Two views of the Moon imaged on 2016 Feb 11, orientated with north towards the top. **(Left)** An image by Marc Charron (Reading Astronomical Society) taken at 17:57 UT that I have purposefully over contrast stretched to see bring out detail on the terminator, and to see if there is any Earthshine visible? **(Right)** Lunar Earthshine as videoed by Cantarella and Luigi Zantatta (UAI) at 19:17 UT. The red circle shows a possible cosmic ray detection. Note that this is a single TV frame and shows remarkable detail.

Mare Crisium NW Rim: On 2016 Feb 12 UT 00:40-01:00 Jay Albert observed this area under the same illumination and topocentric libration (to within ±1˚) to a LTP report by Raffaello Braga from 1998:

> *Mare Crisium 1998 Jan 31 UT 17:15-17:35 R. Braga (Corsica (MI), Italy, 102mm f8.8 refractor, x180, with no diagonal, seeing II, Transparency poor). A very bright point located at 23N 54.5E this was normal! - what was unusual was that it vanished when viewed through a blue Wratten 38A filter (this filter absorbs red, UV, and some green light). The ALPO/BAA weight=3.*

Jay observed visually from 00:40-01:00UT using a 6" SCT. He too saw a very bright point that looked like a summit at the approximate coordinates given in the original LTP report (23°N, 54.5°E). The bright point was on the NNW edge of Crisium and roughly south of Cleomedes. As in the LTP description, the bright point vanished when viewed through a Wratten 38A blue filter, however, it was easily seen through a Wratten 80A blue filter. Jay suspected that the Wratten 38A filter may simply have been too dense for this feature, so this may not be a real LTP. I contacted Raffaello Braga to ask if he had any further information about the 1998 report, and what he thought about Jay's theory. Raffaello replied that he had checked his notebook but could not find any additional information. However on 1998 Jun 28 he observed the region again and made a note that: *"M. Crisium fully illuminated. The same point already reported at about 23N 55E very bright in integral light and through the W25 filter, considerably darker through 38A. With this filter other illuminated features in the*

region (e.g. crater Eimmart) don't appear so dark.... A further note on crater Eimmart, same date: "SW portion of the crater is brighter in blue and darker in red". So Raffaello's comments may exclude the theory that the Wratten 38A filter was too just opaque and caused the anomaly seen in 1998. However as both observers noticed a darkening in the blue, this appears to be normal behaviour for this feature at the same illumination and viewing angle, so I will reduce the ALPO/BAA weight from 3 to a 2, as I would very much like to receive some unsaturated color images of this spot to check out the filter responses observed. Both Jay Albert and Gary Varney (ALPO) obtained some images of the area on 2016 Feb 12 (See Fig 3).

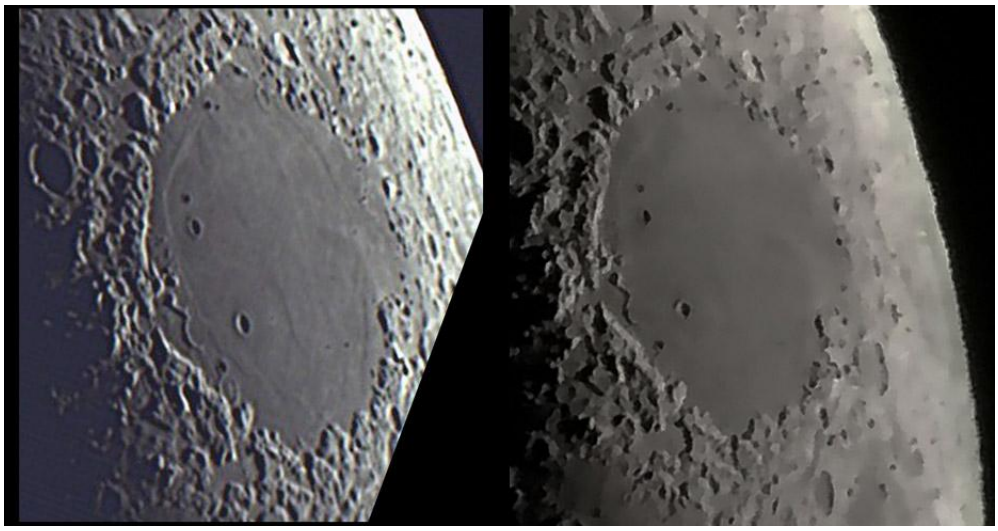


Figure 3. Mare Crisium orientated with north towards the top, taken on 2016 Feb 12. **(Left)** Image by Jay Albert (ALPO) taken at UT 00:22. **(Right)** Image taken by Gary Varney (ALPO) on UT 02:21, taken with an iPhone on an Orion XT8 telescope, through a 20 mm Plossl eyepiece.

Eudoxus: On 2016 Feb 14 UT 07:45-07:47 Maurice Collins (ALPO) imaged the whole Moon and covered Eudoxus (See Fig 4a (Left)) under the same illumination conditions (to within ±0.5˚) to the following report from 1881:

On 1881 May 04 at UT 20:00? Trouvelot (Meudon, France) observed an unexplained light inside Eudoxus crater. The Cameron 1978 catalog ID=222 and the weight=3. The ALPO/BAA weight=3.

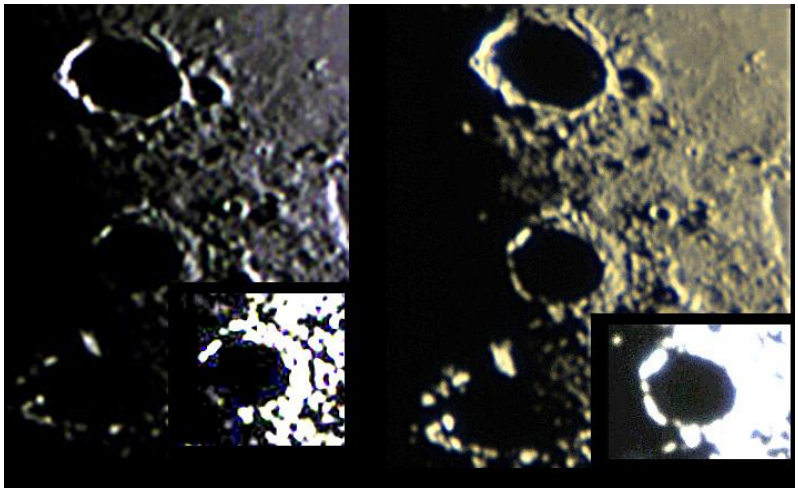


Figure 4. Eudoxus crater (near centre) on 2016 Feb 14, taken by Maurice Collins (ALPO), orientated with north towards the top. Contrast enhanced inserts have been provided which show a bit more detail in the interior. **(Left)** Taken from an image mosaic made between 07:45-07:47 UT. **(Right)** Taken at 08:28 UT.

Maurice also obtained another image slightly outside the repeat illumination window, but at higher resolution/quality (See Fig 4 (Right)). I have been unable to find a sketch of the 1881 report however it is mentioned in Vol. 23 of the Astronomical Register of the Royal Astronomical Society (p236-237):

> *"On May 4th 1881, Eudoxus being close to the terminator, a bright spot, slightly elongated from north to south, was noticed, exactly at the place where the thread of light observed in 1877 terminated, viz., opposite the notch in the* eastern *wall. This object was probably a portion of the craterlet that the notch apparently represents. On April 23rd, 1885, the E*(W?)*. long, of the morning terminator being about 21˚, the floor of the ring-plain, then in sunlight, was carefully examined without any traces of the wall being perceived, though on the* east *rocks and debris, arranged in a straight line, were seen on the site of the luminous filament remarked in 1877."* – Note I have changed Classical East, West in the above to the more modern IAU direction sense – where the changes have taken place, these have been underlined.

Although the 20:00 UT time for 1881 observation is an estimate (I assume the NASA catalog has it correct that Trouvelot was observing from Meudon, rather than from the USA?), the images taken by Maurice show no sign of what Trouvelot describes. So I can only assume what was seen in on 1881 May 04 was an unusual appearance of the crater. For more information on an earlier sighting of a thread like feature across the floor of Eudoxus, see Nigel Longshaw's BAA Journal (Vol 117, No. 4, p187-197) paper: Trouvelot's Threads: The 'Mur Enigmatique' of Etienne Leopold Trouvelot and a subsequent letter: Eudoxus Revisted: A Comparison of Lunar Images. I will certainly keep the weight at 3, and hope that people study the crater at repeat illumination dates/times for all of Trouvelot's reported sightings of a thread like feature across the floor of the crater.

Albategnius: On 2016 Feb 15 UT 19:30-19:40 Marie Cook (BAA) and at 19:37 Nigel Longshaw (BAA) examined this crater under the same illumination conditions (to within ±0.5˚) to the following report from 1979 by none other than myself:

> *Albategnius 1979 Sep 28 UT 19:15-19:17 Observed by Cook (Frimley, UK, 13m Monocentric eyepiece + Barlow + Moonblink, seeing Antoniadi V, transparency: poor and cloud halted observations) "Almost certainly spurious color seen red on west and blue on east"*

Marie commented that *"No color seen at all with the crater. Features sharp and clear. Normal."* – her seeing conditions were Antoniadi II and transparency was good. Nigel Longshaw commented that: *"At 19.37 UT I could not see any spurious color in Albateginus. Seeing by this time had improved slightly and there was no spurious color seen in any features in the region. The west wall of Klein was brightly illuminated and did exhibit a very slight spurious color effect at its lower and upper margins, but this had to be really looked for and no doubt was a result of the less than perfect seeing conditions"*.

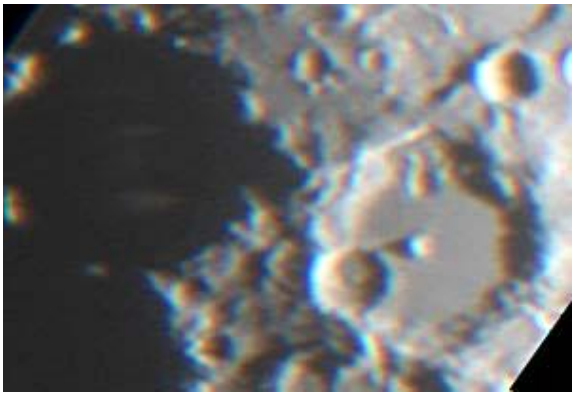


Figure 5. 2016 Feb 15 UT 20:18 extracted video frame from Tony Cook's 20:09-20:32 monochrome webcam recording of the Moon. Artificial atmospheric blurring and spectral dispersion have been added to try to simulate the 1979 observational report.

Upon reflection, looking back at my original notes, it seems it was a bit presumptuous to place this observation in the LTP database at all, considering the observing conditions. However it was added nevertheless just in case there was a slight chance the color seen was not due to atmosphere. Marie Cook and Nigel Longshaw's observations, made under good observing conditions, show that there are no natural color effects present on the surface which might have explained what was seen in 1979. A simulation of atmospheric spectral dispersion with a frame from a monochrome web camera recording from the same night (Fig 5) shows quite plainly that atmospheric spectral dispersion can produce red shading on the west and blue in the east. I will therefore remove this observation from the LTP database by setting its weight to 0.

Ptolemaeus: On 2016 Feb 15 UT 19:45-20:12 Nigel Longshaw (BAA) examined this crater under the same illumination conditions (to within ±0.5˚) for the following 1970 Brazilian LTP report:

> *Ptolemaeus 1970 Apr 14 UT 00:45-01:30 Observed by Nelson Travnik and Sergio Vienna (Matias Barbosa, Minas Gerais, Brazil, 4" refractor, x250, x400, - observing conditions very good, Kodak Wratten 15 and 23 filters used) "A kind of glimmering mist lifted and wafted inside the shady hollow of the crater (Apollo 13 watch)" NASA catalog weight=3 NASA catalog ID #1248. ALPO/BAA weight=2.*

Nigel comments that he followed the early sunrise over the floor of Ptolemaeus carefully. He saw the first light, light streaks appeared on the southern floor right along until the shadow spires from the eastern wall started to become apparent on the crater floor. Here are his detailed notes:

> *19:45 UT - First glimmer of illumination on the southern floor*
>
> *19:55 UT - A second streak of light appeared very faint on the central region of the floor - the crater floor between the two streaks now appeared to exhibit a faint 'glow' similar to sunrise and sunset on the interior of Plato.*
>
> *20:02 UT - A further 'streak' appeared on the northern floor.*
>
> *20:04 UT - First 'streak' now brighter and wider at its western end.*
>
> *20:07 UT - The second 'streak of light now brighter, sharply defined, needle like.*
>
> *20:09 UT - Western floor (almost to w. wall) now appears marginally brighter than the eastern floor which remains fully in shadow - the appearance of shadow spires cast by the eastern wall is now becoming apparent on the crater floor.*
>
> *20:12 UT - First 'streak' is now fan shaped with western tip appearing to extend as a faint area of light.*

Nigel speculates that as these lighter regions appeared and grew their illumination levels gradually increased. He felt that *"The appearance of these lighter regions and their apparent 'growth' as illumination levels increased, coupled with the somewhat disorientating aspect"* might have made it difficult to distinguish the level at which these features were developing, and this could possibly provide an explanation for the original description of a *'glimmering mist'* – perhaps even if one considers atmospheric seeing effects this might have instilled in the original observer a feeling of movement of these features within the crater. Nigel continues that as lunar sunrise proceeds *"The interior shadows do appear to lift rapidly, as they do in other large smooth floored craters with relatively low walls. This adds to the sense of 'movement' and without the benefit of 'fixity' provided by the appearance of readily defined shadow edges the whole effect is one of amorphous shapes undergoing changes".* Nigel ponder whether the fact that the observers used a relatively small instrument, at rather high powers, might offer some plausibility to the above theory to explain the original observation? Just out of interest, although a little later, and artificially degraded, we can see some of the shadow bands on the floor of Ptolemaeus in Fig 5. A much more detailed image sequence was taken by C.F. Bowron (Doncaster, UK – BAA) as shown on p7 of the March 2016 edition of the BAA Lunar Section Circular – the earliest streak visible on the floor here was at 20:00UT. So the fact that Nigel saw illumination of the floor some 15 minutes earlier, shows the great light sensitivity capability of the human eye.

Alphonsus: On 2016 Feb 18 UT 22:27-22:40 Kevin Berwick observed this crater under similar illumination (to within ±0.5˚) o a 1959 LTP report:

Alphonsus 1959 Feb 18 UT 21:00? Observed by Hole (Brighton, England, 24" reflector) "Red patch (Moore in Survey of the Moon says Jan. '59). Moore says, Warner, in Eng. saw it bright red in an 18-in refr. Hedervari & Botha in Hungary saw red patch & several in US (indep. confirm. ?)" NASA catalog weight=5. NASA catalog ID #714. ALPO/BAA weight=5.

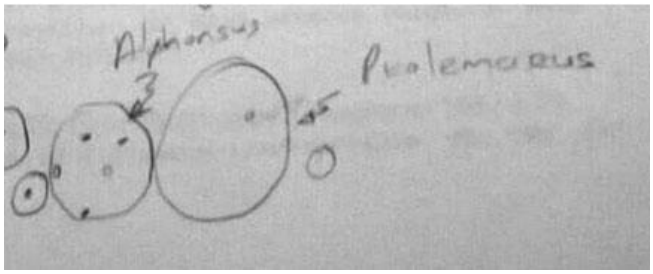


Figure 6. Alphonsus and Ptolemaeus as sketched by Kevin Berwick (ALPO) orientated with North towards the right - but East and West mirror imaged.

Kevin commented that there was nothing unusual see on the crater, and certainly no red patches (See Fig 6). When he looked, Alphonsus was far from the terminator and not much relief was visible, however the usual three obvious dark patches were visible on the floor, as well as two light patches. He wondered if chromatic aberration in the vicinity of these patches could explain the red patch? Certainly this might be possible with the 18" refractor, but not with the 24" reflector. I will lower the weight from 5 to 4 as some of the details in the Cameron catalog, have some uncertainty e.g. the UT of 21:00 seems to be estimated.

Bianchini G: On 2016 Feb 19 UT 03:30-04:00 Alberto Anunziato (AEA), using a Meade EX 105 at x154 magnification, observed the Sinus Iridum area under the same illumination (to within ±0.5˚) conditions to a LTP report from 1987:

On 1987 Sep 04 at UT 03:00 J. Caruso (Middletown, CT, USA, 3" refractor, x155, S=6/10 and T=8/10) found that Bianchini G was not visible, however Heraclides E, Helicon G, and indeed many other smaller craters could be seen. There were two small mountains in the general area of Bianchini G. and a mare ridge - all these were clearly seen. Caruso states that Bianchini G should normally be much more clearly seen than the other features mentioned and is the same size as Heraclides E. The Cameron 2006 catalog ID=305 and the weight=3. The ALPO/BAA weight=3.

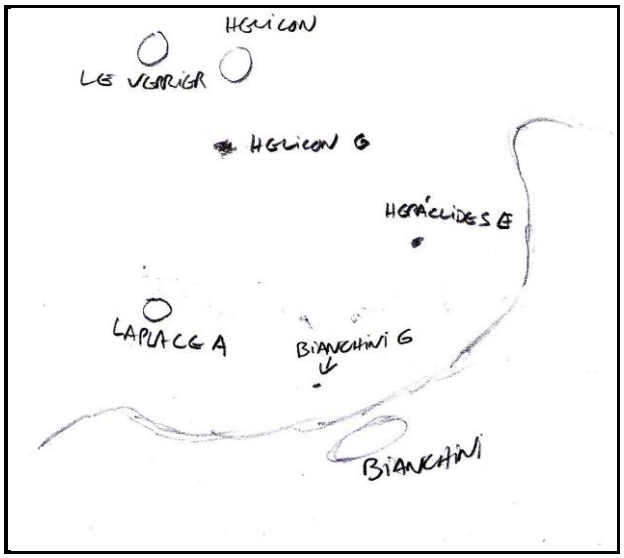


Figure 7. A sketch of the Sinus Iridum area by Alberto Anunziato, orientated with north towards the bottom, made on 2016 Feb 19 UT 03:30-04:00.

Alberto's sketch can be seen in Fig 7, and he noted that although he could see Heraclides E and Helicon G, easily, he found Bianchini G very difficult to discern. He went on further to say that without knowing in advance where Bianchini G was, he would not be able to place it. He could not see any mountain or ridge though mentioned in the original description. In view of these comments, I will lower the weight from 3 to 1 as Bianchini G is normally difficult to see, but will not remove the LTP completely from the catalog because of the lack of descriptions of the two mountains and small ridge is curious, and makes me wonder if there was a date or UT error in the original report - which unfortunately I do not have a copy of.

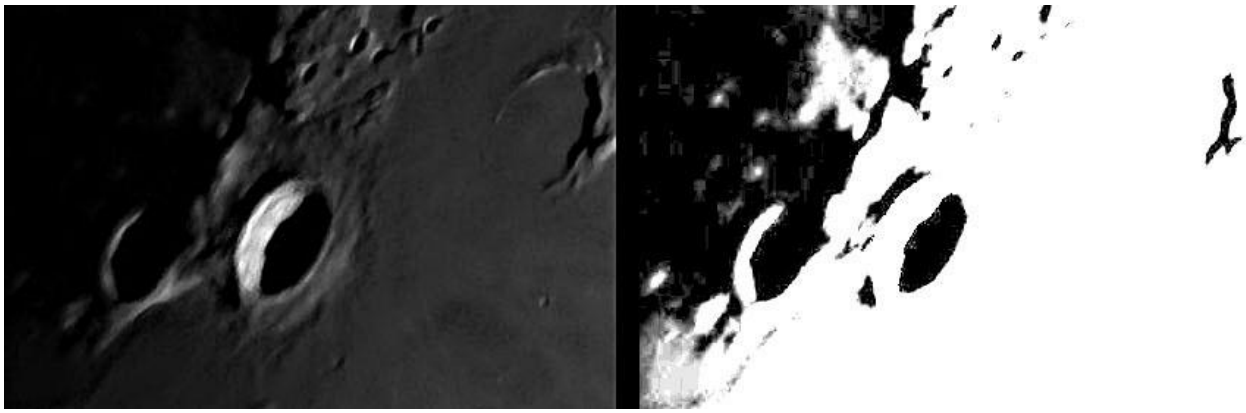


Figure 8. Herodotus and Aristarchus orientated with north towards the top as images by Aldo Tonon (UAI). **(Left)** Default exposure image. **(Right)** Highly contrast stretched to look for detail in the shadowed floor of Herodotus.

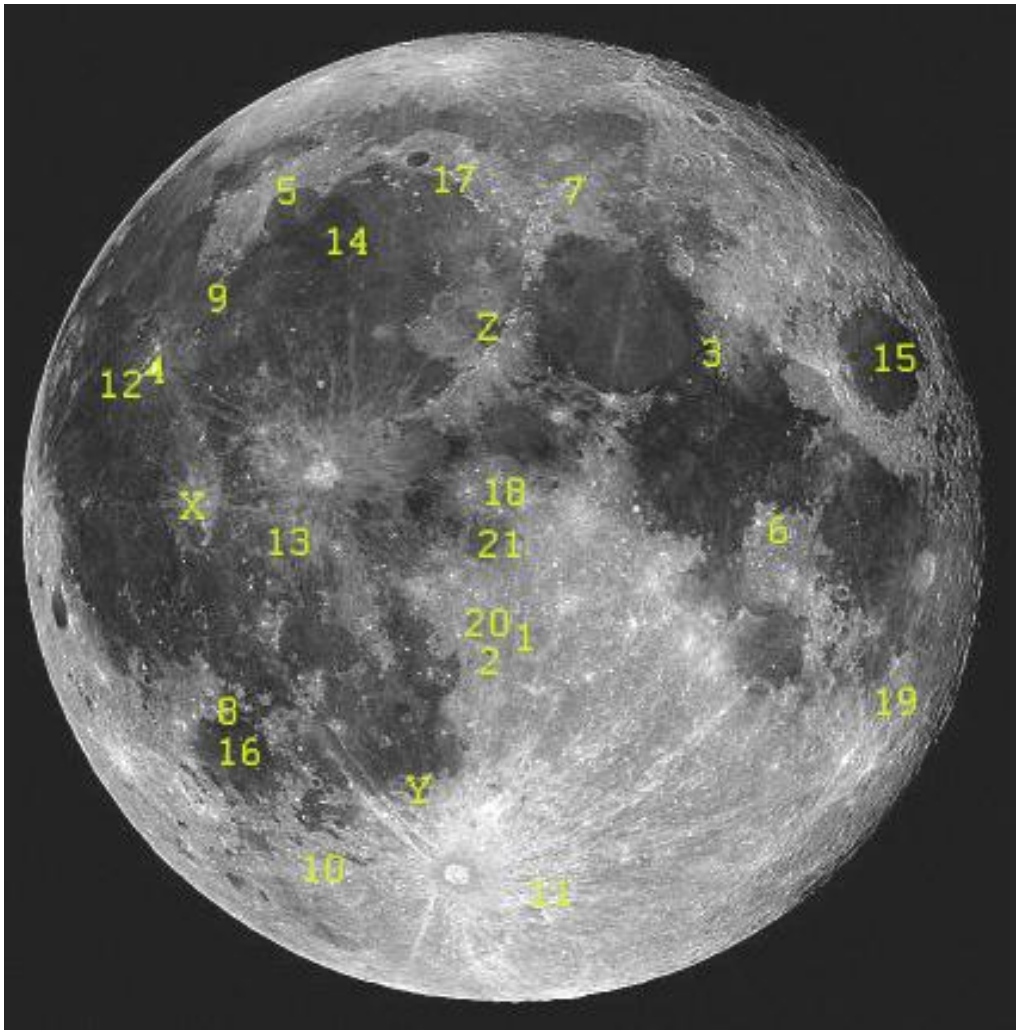
Herodotus: On 2016 Feb 19 UT 21:52 Aldo Tonon observed this crater under similar colongitude to what some astronomers have reported seeing a pseudo peak at. Aldo's image in Fig 8, shows two views: the ordinary well exposed version (Fig 8 (Left)) and a contrast stretched version (Fig 8 (Right)). There is no sign of any pseudo peak in the shadow, and its origin remains a mystery, To read further details about this interesting, but rarely observed effect see the paper by myself and Tom Dobbins in: "The Pseudo Peak of Herodotus", published in The Moon: Occasional Papers of the Lunar Section of the British Astronomical Association Vol. 2, Dec 2012., p22-35, the pseudo peak is normally not visible, but when it has been reported, then it seems to lie between selenographical co-longitudes of 52.6° to 58.7°.

General Information: For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: http://users.aber.ac.uk/atc/lunar_schedule.htm . By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try "Spot the Difference" between spacecraft imagery taken on different dates? This can be found on: http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on http://users.aber.ac.uk/atc/alpo/ltp.htm , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on https://twitter.com/lunarnaut .

Dr Anthony Cook, Institute of Mathematical and Physical Sciences, University of Wales Aberystwyth, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, WALES, UNITED KINGDOM. Email: atc @ aber.ac.uk.

KEY TO IMAGES IN THIS ISSUE

1. **Albetegnius**
2. **Alphonsus**
3. **Apollo 17**
4. **Aristarchus**
5. **Bianchini**
6. **Censorinus**
7. **Eudoxus**
8. **Gassendi**
9. **Gruithuisen**
10. **Hainzel**
11. **Heraclitus**
12. **Herodotus**
13. **Lansberg**
14. **Le Verrier**
15. **Mare Crisium**
16. **Mare Humorum**
17. **Montes Alpes**
18. **Murchison**
19. **Petavius**
20. **Ptolemaus**
21. **Sinus Medii**



FOCUS ON targets

X = Kepler
Y = Capuanus
Z = Montes Apennines